# THE ASTROPHYSICAL JOURNAL

Founded in 1895 by George E. Hale and James E. Keeler

HELMUT A. ABT

Editor-in-Chief

Kitt Peak National Observatory

Scientific Editors

GREGORY D. BOTHUN University of Oregon GEOFFREY BURBIDGE University of California, San Diego ANNE P. COWLEY Arizona State University

BERNHARD M. HAISCH Solar and Astrophysics Lab., Lockheed Martin

STEVEN N. SHORE Indiana University, South Bend EDWARD M. SION Villanova University CHRISTOPHER SNEDEN University of Texas YERVANT TERZIAN
Cornell University

JOHN H. THOMAS University of Rochester VIRGINIA TRIMBLE University of Maryland and University of California, Irvine STEVEN P. WILLNER Smithsonian Astrophysical Observatory EDWARD L. WRIGHT University of California, Los Angeles

A. DALGARNO

Letters Editor

Center for Astrophysics

EUGENE H. AVRETT Deputy Letters Editor Center for Astrophysics

#### AAS PUBLICATIONS BOARD

ROBERT J. HANISCH (1996-1999), Chairperson Space Telescope Science Institute

JAMES J. CONDON (1994–1997) NRAO, Charlottesville, Virginia JOHN A. NOUSEK (1994–1997) Pennsylvania State University

DIMITRI M. MIHALAS (1996–1999) University of Illinois KAREN S. BJORKMAN (1996–1999) University of Toledo MOSHE ELITZUR (1995–1998) University of Kentucky

SUSAN TEREBEY (1997-2000) California Institute of Technology

Publication Manager: JULIE STEFFEN

Production Manager: KIM LANGFORD

Chief Manuscript Editor: GERALDINE BRADY

Manuscript Editors: Walter G. Glascoff III, Beth Garrison, Thad A. Doria, Greg M. Hajek, Paul Ruich, Kenneth Hite, Ivan Brunetti, Sharon Jennings, David Kielpinski, and Maureen E. Callahan

Electronic Publishing Coordinators: Sara Zimmerman and John Myer

Production Staff: CINDY GARRETT, CAROLYN B. CHMIEL, EMILY CLARK, SUCHITRA GURURAJ, AND ELISSA PARK

Tucson Editorial Office: Janice Sexton, Alice Prochnow, Candace M. Hauser, Marlene Saltzman, Cheyenne Ross, and Rachel Williams

VOLUME 483, PART 1 1997 JULY 1 AND JULY 10

 $\ \, \bigcirc$  1997 by the american astronomical society. All rights reserved. Published three times a month

COMPOSED BY SANTYPE INTERNATIONAL LIMITED, SALISBURY, ENGLAND PRINTED BY CAPITAL CITY PRESS, INC.

MONTPELIER, VERMONT, U.S.A.

# THE ASTROPHYSICAL JOURNAL CONTENTS OF VOLUME 483, PART 1

# 1997 JULY 1, Number 1

	Page
THE SIGNATURE OF A CORRELATION BETWEEN COSMIC-RAY SOURCES ABOVE 10 <sup>19</sup> eV AND LARGE-SCALE STRUCTURE Eli Waxman, Karl B. Fisher, & Tsvi Piran	1
SIZES, SHAPES, AND CORRELATIONS OF LYMAN ALPHA CLOUDS AND THEIR EVOLUTION IN THE ACDM UNIVERSE  Renyue Cen & Robert A. Simcoe	8
SIGNATURES OF STELLAR REIONIZATION OF THE UNIVERSE Zoltán Haiman & Abraham Loeb	21
SMALL-SCALE COSMIC MICROWAVE BACKGROUND OBSERVATIONS AT 8.4 GHz R. Bruce Partridge, Eric A. Richards, Edward B. Fomalont, K. I. Kellermann, & Rogier A. Windhorst	38
THE ESTIMATION OF THE NOISE IN COSMIC MICROWAVE BACKGROUND ANISOTROPY EXPERIMENTS $C.M.Guti\acute{e}rrez$	51
THE BEAMING PATTERN OF DOPPLER-BOOSTED THERMAL ANNIHILATION RADIATION: APPLICATION TO MeV BLAZARS  Jeffrey G. Skibo, Charles D. Dermer, & Reinhard Schlickeiser	56
A STATISTICAL COMPARISON OF CLUSTER MASS ESTIMATES FROM OPTICAL/X-RAY OBSERVATIONS AND GRAVITATIONAL LENSING Xiang-Ping Wu & Li-Zhi Fang	62
X-RAY EMISSION FROM OPTICALLY SELECTED GALAXY GROUPS Andisheh Mahdavi, Hans Böhringer, Margaret J. Geller, & Massimo Ramella	68
DECAYING NEUTRINOS AND THE EXTRAGALACTIC BACKGROUND LIGHT J. M. Overduin & P. S. Wesson	77
COSMOLOGICAL EVOLUTION OF DWARF GALAXIES: THE INFLUENCE OF STAR FORMATION AND THE MULTIPHASE INTERSTELLAR MEDIUM Marco Spaans & Colin A. Norman	87
MEASURING THE ROTATION SPEED OF GIANT STARS FROM GRAVITATIONAL MICROLENSING $\it Andrew Gould$	98
DOES THE MILKY WAY HAVE A MAXIMAL DISK?  Penny D. Sackett	103
THERMAL CONDUCTION IN ACCRETION DISK CORONAE  Andrzej Maciołek-Niedźwiecki, Julian H. Krolik, & Andrzej A. Zdziarski	111
THE STABILITY OF RADIATIVELY COOLING JETS. I. LINEAR ANALYSIS Philip E. Hardee & James M. Stone	121
THE STABILITY OF RADIATIVELY COOLING JETS. II. NONLINEAR EVOLUTION James M. Stone, Jianjun Xu, & Philip E. Hardee	136
THE INTRINSIC PROPERTIES OF THE STELLAR CLUSTERS IN THE M82 STARBURST COMPLEX: PROPAGATING STAR FORMATION?  S. Satyapal, Dan M. Watson, J. L. Pipher, W. J. Forrest, M. A. Greenhouse, H. A. Smith, J. Fischer, & Charles E. Woodward	148
MULTIWAVELENGTH OBSERVATIONS OF 3C 273 IN 1993–1995 C. von Montigny, H. Aller, M. Aller, F. Bruhweiler, W. Collmar, T. JL. Courvoisier, P. G. Edwards, C. E. Fichtel, A. Fruscione, G. Ghisellini, R. C. Hartman, W. N. Johnson, M. Kafatos, T. Kii, D. A. Kniffen, G. G. Lichti, F. Makino, K. Mannheim, A. P. Marscher, B. McBreen, I. McHardy, J. E. Pesce, M. Pohl, E. Ramos, W. Reich, E. I. Robson, K. Sasaki, H. Teräsranta, M. Tornikoski, C. M. Urry, E. Valtaoja, S. Wagner, & T. Weekes	161

	Page
HST AND MERLIN OBSERVATIONS OF 3C 264—A LABORATORY FOR JET PHYSICS AND UNIFIED SCHEMES	178
Stefi A. Baum, Christopher P. O'Dea, Gabriele Giovannini, John Biretta, William B. Cotton, Sigrid de Koff, Luigina Feretti, Daniel Golombek, Lucas Lara, Ferdinando D. Macchetto, G. K. Miley, William B. Sparks, Tiziana Venturi, & Serguei S. Komissarov	
POLARIZATION OF LINE EMISSION FROM AN ACCRETION DISK AND APPLICATION TO ARP 102B Kaiyou Chen, Jules P. Halpern, & Lev G. Titarchuk	194
[C II] 158 MICRON OBSERVATIONS OF IC 10: EVIDENCE FOR HIDDEN MOLECULAR HYDROGEN IN IRREGULAR GALAXIES S. C. Madden, A. Poglitsch, N. Geis, G. J. Stacey, & C. H. Townes	200
THE DENSITY AND TEMPERATURE OF MOLECULAR CLOUDS IN M33 Christine D. Wilson, Constance E. Walker, & Michele D. Thornley	210
PLACING THE SUN IN GALACTIC CHEMICAL EVOLUTION: MAINSTREAM SIC PARTICLES D. D. Clayton & F. X. Timmes	220
A NEW APPROACH TO DETERMINE THE INITIAL MASS FUNCTION IN THE SOLAR NEIGHBORHOOD Takuji Tsujimoto, Yuzuru Yoshii, Ken'ichi Nomoto, Francesca Matteucci, Friedrich-Karl Thielemann, & Masaaki Hashimoto	228
THE PHYSICS AND CHEMISTRY OF SMALL TRANSLUCENT MOLECULAR CLOUDS. VIII. HCN AND HNC B. E. Turner, L. Pirogov, & Y. C. Minh	235
THE SURVIVAL OF INTERSTELLAR CLOUDS AGAINST KELVIN-HELMHOLTZ INSTABILITIES Mario Vietri, Andrea Ferrara, & Francesco Miniati	262
LARGE-SCALE STRUCTURES IN THE INTERSTELLAR MEDIUM M. E. Katz & V. M. Yacobi	274
SYNCHROTRON AGING IN FILAMENTED MAGNETIC FIELDS J. A. Eilek, D. B. Melrose, & M. A. Walker	282
GOLD ALIGNMENT AND INTERNAL DISSIPATION A. Lazarian	296
COLLAPSE AND FRAGMENTATION OF MOLECULAR CLOUD CORES. V. LOSS OF MAGNETIC FIELD SUPPORT Alan P. Boss	309
THE <sup>3</sup> He ABUNDANCE IN PLANETARY NEBULAE Dana S. Balser, T. M. Bania, Robert T. Rood, & T. L. Wilson	320
AUSTRALIA TELESCOPE OBSERVATIONS OF THE CTB 33 COMPLEX A. P. Sarma, W. M. Goss, A. J. Green, & D. A. Frail	335
NONPARAMETRIC ESTIMATION OF GAMMA-RAY BURST INTENSITIES USING HAAR WAVELETS Eric D. Kolaczyk	340
A METHOD BASED ON WAVELET TRANSFORMS FOR SOURCE DETECTION IN PHOTON-COUNTING DETECTOR IMAGES. I. THEORY AND GENERAL PROPERTIES F. Damiani, A. Maggio, G. Micela, & S. Sciortino	350
A METHOD BASED ON WAVELET TRANSFORMS FOR SOURCE DETECTION IN PHOTON-COUNTING DETECTOR IMAGES. II. APPLICATION TO ROSAT PSPC IMAGES F. Damiani, A. Maggio, G. Micela, & S. Sciortino	370
PARALLEL IMPLEMENTATION OF THE PHOENIX GENERALIZED STELLAR ATMOSPHERE PROGRAM Peter H. Hauschildt, E. Baron, & France Allard	390
INTRINSIC KICKS AT BIRTH ARE REQUIRED TO EXPLAIN THE OBSERVED PROPERTIES OF SINGLE AND BINARY NEUTRON STARS  E. P. J. van den Heuvel & J. van Paradijs	399
MODULATIONAL INSTABILITY, MODE CONVERSION, AND RADIO EMISSION IN THE MAGNETIZED PAIR PLASMA OF PULSARS  James C. Weatherall	402
PHOTOIONIZATION OF HYDROGEN IN ATMOSPHERES OF MAGNETIC NEUTRON STARS Alexander Y. Potekhin & George G. Pavlov	414
WAVELET ANALYSIS OF STELLAR CHROMOSPHERIC ACTIVITY VARIATIONS P. Frick, S. L. Baliunas, D. Galyagin, D. Sokoloff, & W. Soon	426

HIGH CHROMOSPHERES OF LATE A STARS Theodore Simon & Wayne B. Landsman	Page 435
TOMOGRAPHIC SEPARATION OF COMPOSITE SPECTRA. IV. THE PHYSICAL PROPERTIES OF THE MASSIVE CLOSE BINARY DH CEPHEI Laura R. Penny, Douglas R. Gies, & William G. Bagnuolo, Jr.	439
THE STAR-GRAZING EXTRASOLAR COMETS IN THE HD 100546 SYSTEM C. A. Grady, M. L. Sitko, Karen S. Bjorkman, Mario R. Pérez, D. K. Lynch, R. W. Russell, & M. S. Hanner	449
THE DISCOVERY OF A PLANETARY COMPANION TO 16 CYGNI B William D. Cochran, Artie P. Hatzes, R. Paul Butler, & Geoffrey W. Marcy	457
A GENERALIZED MODEL FOR THE PROTON EXPANSION IN ASTROPHYSICAL WINDS.  I. THE VELOCITY DISTRIBUTION FUNCTION REPRESENTATION  F. LeBlanc & D. Hubert	464
STELLAR SAPPHIRES: THE PROPERTIES AND ORIGINS OF PRESOLAR ${\rm Al}_2{\rm O}_3$ IN METEORITES Larry R. Nittler, Conel M. O'D. Alexander, Xia Gao, Robert M. Walker, & Ernst Zinner	475
FOKKER-PLANCK DESCRIPTION OF ELECTRON BEAMS IN THE SOLAR CHROMOSPHERE Pablo J. D. Mauas & Daniel O. Gómez	496
MOVING PLASMOID AND FORMATION OF THE NEUTRAL SHEET IN A SOLAR FLARE $Saku\ Tsuneta$	507
ENERGY SPECTRA OF IONS ACCELERATED IN IMPULSIVE AND GRADUAL SOLAR EVENTS D. V. Reames, L. M. Barbier, T. T. Von Rosenvinge, G. M. Mason, J. E. Mazur, & J. R. Dwyer	515
ESTIMATIONS OF MAUNDER MINIMUM SOLAR IRRADIANCE AND Ca $\pi$ H AND K FLUXES USING ROTATION RATES AND DIAMETERS Blanca Mendoza	523
CHARGE TRANSFER BETWEEN GROUND-STATE Si <sup>3+</sup> AND He AT ELECTRON-VOLT ENERGIES Z. Fang & Victor H. S. Kwong	527
COMPLETE BRANCHING RATIOS FOR THE DISSOCIATIVE RECOMBINATION OF H <sub>2</sub> O <sup>+</sup> , H <sub>3</sub> O <sup>+</sup> , AND CH <sub>3</sub> <sup>+</sup> L. Vejby-Christensen, L. H. Andersen, O. Heber, D. Kella, H. B. Pedersen, H. T. Schmidt, & D. Zajfman	531
NEW INSTRUCTIONS TO AUTHORS	i
1997 JULY 10, Number 2	
THIRD-ORDER PERTURBATIVE APPROACH TO GRAVITATIONAL INSTABILITY: EVOLUTION OF ISOLATED STRUCTURES AND ENVIRONMENTAL EFFECTS  L. J. Goicoechea & J. Buitrago	541
SPHERICAL HARMONIC EXPANSION OF GAMMA-RAY BURST DISTRIBUTIONS: PROBING LARGE-SCALE STRUCTURE?  Tsvi Piran & Anupam Singh	552
IS DEUTERIUM IN HIGH-REDSHIFT LYMAN LIMIT SYSTEMS PRIMORDIAL?  Karsten Jedamzik & George M. Fuller	560
MEASUREMENTS OF THE COSMOLOGICAL PARAMETERS Ω AND Λ FROM THE FIRST SEVEN SUPERNOVAE AT z ≥ 0.35 S. Perlmutter, S. Gabi, G. Goldhaber, A. Goobar, D. E. Groom, I. M. Hook, A. G. Kim, M. Y. Kim, J. C. Lee, R. Pain, C. R. Pennypacker, I. A. Small, R. S. Ellis, R. G. McMahon, B. J. Boyle, P. S. Bunclark, D. Carter, M. J. Irwin, K. Glazebrook, H. J. M. Newberg, A. V. Filippenko, T. Matheson, M. Dopita, & W. J. Couch (The Supernova Cosmology Project)	565
THE HOMOGENEITY OF SPHEROIDAL POPULATIONS IN DISTANT CLUSTERS Richard S. Ellis, Ian Smail, Alan Dressler, Warrick J. Couch, Augustus Oemler, Jr., Harvey Butcher, & Ray M. Sharples	582
CONSTRAINTS ON THE REDSHIFT AND LUMINOSITY DISTRIBUTIONS OF GAMMA-RAY BURSTS IN AN EINSTEIN-DE SITTER UNIVERSE Daniel E. Reichart & P. Mészáros	597
VERY STRONG MICROLENSING OF DISTANT LUMINOUS STARS BY RELIC MASSIVE BLACK HOLES Edwin L. Turner & Masayuki Umemura	603
FORMATION OF STELLAR BARS IN A COLLAPSING AND SELF-GRAVITATING TWO-COMPONENT FLUID  Kenji Bekki	608

	Page
HALO WHITE DWARFS AND THE HOT INTERGALACTIC MEDIUM Brian D. Fields, Grant J. Mathews, & David N. Schramm	625
ON THE ORIGIN OF METALLICITY IN Lyα FOREST SYSTEMS Masashi Chiba & Biman B. Nath	638
THE EVOLUTION OF A PRIMORDIAL GALACTIC MAGNETIC FIELD Armando M. Howard & Russell M. Kulsrud	648
OPTICAL SPECTROSCOPY OF DIFFUSE IONIZED GAS IN M31 B. Greenawalt, R. A. M. Walterbos, & R. Braun	666
SN 1983V IN NGC 1365 AND THE NATURE OF STRIPPED ENVELOPE CORE-COLLAPSE SUPERNOVAE A. Clocchiatti, J. C. Wheeler, M. M. Phillips, N. B. Suntzeff, S. Cristiani, A. Phillips, R. P. Harkness, M. A. Dopita, K. Beuermann, M. Rosa, P. Grosbøl, P. O. Lindblad, & A. V. Filippenko	675
MEASUREMENTS OF He 1 \$5876 RECOMBINATION-LINE RADIATION FROM THE DIFFUSE, WARM IONIZED MEDIUM IN IRREGULAR GALAXIES  Crystal L. Martin & Robert C. Kennicutt, Jr.	698
ARE THE SUPER-STAR CLUSTERS OF NGC 1569 IN A POSTSTARBURST PHASE? Rosa M. González Delgado, Claus Leitherer, Timothy Heckman, & Miguel Cerviño	705
GHRS MONITORING OF THE OUTFLOWING MATERIAL IN NGC 4151 Ray J. Weymann, Simon L. Morris, Meghan E. Gray, & John B. Hutchings	717
ORBITS IN THE BAR OF NGC 4314 P. A. Patsis, E. Athanassoula, & A. C. Quillen	731
THE SURFACE BRIGHTNESS FLUCTUATIONS AND GLOBULAR CLUSTER POPULATION OF NGC 4478 Eric H. Neilsen, Jr., Zlatan I. Tsvetanov, & Holland C. Ford	745
ATOMIC HYDROGEN AND STAR FORMATION IN THE BRIDGE/RING INTERACTING GALAXY PAIR NGC 7714/7715 (ARP 284)  Beverly J. Smith, Curtis Struck, & Richard W. Pogge	754
X-RAY OBSERVATIONS OF THE BROAD-LINE RADIO GALAXY 3C 390.3  Karen M. Leighly, Paul T. O'Brien, Rick Edelson, Ian M. George, Matthew A. Malkan, Masaru Matsuoka, Richard F. Mushotzky, & Bradley M. Peterson	767
AN X-RAY ABSORPTION FEATURE IN THE BL LACERTAE OBJECT H1426+428 Rita M. Sambruna, I. M. George, G. Madejski, C. Megan Urry, T. J. Turner, K. A. Weaver, L. Maraschi, & A. Treves	774
IMAGES OF THE HOT SPOTS IN CYGNUS A AT 87 GHz M. C. H. Wright, L. M. Chernin, & J. R. Forster	783
THE PRIMORDIAL ABUNDANCE OF <sup>4</sup> He: AN UPDATE Keith A. Olive, Gary Steigman, & Evan D. Skillman	788
DUST COMPOSITION, ENERGETICS, AND MORPHOLOGY OF THE GALACTIC CENTER Kin-Wing Chan, S. H. Moseley, S. Casey, J. P. Harrington, E. Dwek, R. Loewenstein, F. Városi, & W. Glaccum	798
METAL-RICH RR LYRAE VARIABLES. II. THE PULSATIONAL SCENARIO Giuseppe Bono, Filippina Caputo, Santi Cassisi, Roberta Incerpi, & Marcella Marconi	811
BERKELEY 17: THE OLDEST OPEN CLUSTER?  Randy L. Phelps	826
ON THE ORIGIN OF PLANETARY NEBULA K648 IN GLOBULAR CLUSTER M15 J. F. Buell, R. B. C. Henry, E. Baron, & K. B. Kwitter	837
X-RAY NEBULA AROUND THE GAMMA-RAY PULSAR PSR 1055-52 S. Shibata, T. Sugawara, S. Gunji, S. Sano, M. Tukahara, H. Sakurai, N. Kawai, T. Dotani, K. Tamura, C. Greiveldinger, & H. Ögelman	843
INVARIANCE PRINCIPLE AND BILINEAR RELATIONS OF THE RADIATIVE TRANSFER THEORY. I. Arthur G. Nikoghossian	849
EMISSION FROM CLOSED AND FILLED MAGNETOSPHERIC SHELLS AND ITS APPLICATION TO THE CRAB PULSAR  B. J. Eastlund, B. Miller, & F. Curtis Michel	857
ROSAT AND ASCA OBSERVATIONS OF W50 ASSOCIATED WITH PECULIAR SOURCE SS 433 Samar Safi-Harb & Hakkı Ögelman	868
ADVECTION IN ACCRETION DISK BOUNDARY LAYERS	882

vii

Page THE EVOLVING STRUCTURE OF AG PEGASI, EMERGING FROM THE INTERPRETATION OF THE 887 **EMISSION SPECTRA AT DIFFERENT PHASES** Marcella Contini A DYNAMICAL STUDY OF THE ECLIPSING NOVA OY ARAE 899 Ping Zhao & Jeffrey E. McClintock HUBBLE SPACE TELESCOPE GHRS SPECTROSCOPY OF U GEMINORUM DURING TWO OUTBURSTS 907 Edward M. Sion, Fuhua Cheng, Paula Szkody, Min Huang, Judi Provencal, Warren Sparks, Brian Abbott, Ivan Hubeny, Janet Mattei, & Harry Shipman PHYSICAL PARAMETERS OF THE IRC  $\pm$  10216 CIRCUMSTELLAR ENVELOPE: NEW CONSTRAINTS FROM SUBMILLIMETER OBSERVATIONS 913 Mercè Crosas & Karl M. Menten UBBLE SPACE TELESCOPE SPECTRUM OF SN 1987A AT AN AGE OF 3 YEARS: RADIOACTIVE 925 LUMINESCENCE OF COOL GAS Nikolai N. Chugai, Roger A. Chevalier, Robert P. Kirshner, & Peter M. Challis THE LIMITED INFLUENCE OF PRESSURE GRADIENTS ON LATE-TYPE STELLAR LINE ASYMMETRIES 941 Carlos Allende Prieto, Ramón J. García López, & Javier Trujillo Bueno THE X-RAY SUN IN TIME: A STUDY OF THE LONG-TERM EVOLUTION OF CORONAE OF 947 SOLAR-TYPE STARS Manuel Güdel, Edward F. Guinan, & Stephen L. Skinner CROSS-FIELD CURRENTS: AN ENERGY SOURCE FOR CORONAL MASS EJECTIONS? 961 Richard Wolfson & Bongani Dlamini SIGNATURES OF ACOUSTIC AND MAGNETIC WAVES IN SOLAR AND STELLAR CORONAE Øivind Wikstøl, Philip G. Judge, & Viggo H. Hansteen 972

#### **ERRATUM**

EVAPORATION, TIDAL DISRUPTION, AND ORBITAL DECAY OF STAR CLUSTERS IN A GALACTIC HALO: ERRATUM Eugene R. Capriotti



